Population Survey of the Oyster *Crassostrea virginica* in the Dunk River Estuary, Prince Edward Island, 1973

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B3J 2S7

October 1985

Canadian Manuscript Report of
Fisheries and Aquatic Sciences
No. 1859

86-1375/

Canadian Manuscript Report of Fisheries and Aquatic Sciences

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Canadian Manuscript Report of

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POPULATION SURVEY OF THE OYSTER *CRASSOSTREA VIRGINICA* IN THE DUNK RIVER ESTUARY, PRINCE EDWARD ISLAND, 1973

by

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Cat. No. Fs 97-4/1859E ISSN 0706-6473

Correct citation for this publication:

Hawkins, C.M. and T.W. Rowell. 1985. Population survey of the oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1973. Can. MS Rep. Fish. Aquat. Sci. 1859: iv + 45 p.

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ABSTRACT

Hawkins, C.M. and T.W. Rowell. 1985. Population survey of the oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1973. Can. MS Rep. Fish. Aquat. Sci. 1859: iv + 45 p.

This report is the third in a series of seven which examine the temporal changes in the oyster population of the Dunk River, Prince Edward Island. The report tabularizes and graphically presents information on the distribution, abundance, size, and age composition of oysters collected in 1973. Oyster density ranged from 0-336 m^{-2}. Seventy-six percent of the sampling stations yielded oysters, with those 4 yr old and older being most abundant and representing 37.7% of the population. One, 2, and 3 yr old oysters accounted for 4.1%, 24.7%, and 33.5% of the sampled population respectively. Size frequency histograms for individual stations indicated that spatfall settlement and survival was more regular in the principal fishing areas than in other areas of the Estuary.

RÉSUMÉ

Hawkins, C.M. and T.W. Rowell. 1985. Population survey of the oyster Crassostrea virginica in the Dunk River Estuary, Prince Edward Island, 1973. Can. MS Rep. Fish. Aquat. Sci. 1859: iv + 45 p.

Le présent document est le troisième d'une série de sept rapports portant sur les changements temporels qui touchent la population d'huîtres de la rivière Dunk, Île-du-Prince-Edouard. La rapport présente des renseignements sous forme de tableaux et de graphiques concernant la distribution, l'abondance, la taille et l'âge des huîtres capturées en 1973. La densité des huîtres a varié de 0 à 336 par m^2. Des huîtres ont été capturées dans 76% des stations d'échantillonnage. Les huîtres de 4 ans et plus étaient le plus abondantes et représentaient 37,3% de la population. Celles de un, deux et trois ans représentaient respectivement 4,1%, 24,7% et 33,5% de la population échantillonnée. Les histogrammes de fréquences de la taille dans le différentes stations indiquent que la fixation des larves sur un support et la survie sont plus régulières dans les principales zones de pêche que dans les autres régions de l'estuaire.

INTRODUCTION

This report is the third in a series of seven on the population structure of the oyster, Crassostrea virginica, in the Dunk River Estuary, Prince Edward Island. The extended monitoring program, which began in the summer of 1969, provides detailed information on the distribution, abundance, and size composition of oysters in the Estuary. The data which follow summarize information collected during August 1973.

MATERIALS AND METHODS

The field sampling program was carried out from August 3-8, 1973. A detailed description of the sampling procedure and methods of a data acquisition are provided elsewhere (Hawkins and Rowell 1985a). Sampling procedure for this year differed in that diver reconnaissance information on substrate type, fauna, and flora surrounding each sample site was not recorded. In addition, only length measurements on live oysters were taken from the material collected within each square meter sample. Figure 1 presents the locations of the four transects and their respective station positions in the Dunk River Estuary. A total of 51 stations were occupied in the region.

RESULTS AND DISCUSSION

The stations comprising each transect, along with density per square meter, size range, mean size (in centimeters), and standard deviation of oysters collected, are listed in Table 1. The overall size range of oysters was from 1.0-18.0 cm. Mean size ranged from 4.0-9.7 cm. Density of oysters per square meter ranged from 0-306 individuals. In 23.5% (12 stations) of all the stations occupied no live oysters were found.

Lavoie (1977) proposed three categories for classifying oyster density in Caraquet Bay, New Brunswick. Based on his study we found that 41.2% of the 51 stations examined in the present study fall within his Category 1, low density (≤10 oysters m^{-2}), 43.1% fall within Category 2, intermediate density (11-100 oysters m^{-2}), and 15.7% fall within Category 3, high density (>100 oysters m^{-2}). Lavoie further indicated that areas of intermediate oyster density are preferred by fishermen, since those areas yield good-quality oysters while requiring little culling effort. While this consideration may be significant in a market-direct fishery, it does not apply to the same degree in a relay fishery, such as that in the Dunk River, P.E.I., where the cull size is smaller. Density information based on size (length) and age is more useful in determining the availability of oysters to the fishery and in following recruitment patterns. In comparison with the previous year (1972) (Hawkins and Rowell 1985b), the percentage of stations having low densities has decreased by about 20 percentage points in 1973 while intermediate-density areas have increased by the same amount. The percentage of stations with high densities has remained similar over the last 2 yr. Figures 3a, b, c, and d show the numerical density and distribution of 1, 2, 3, and 4+ yr old oysters respectively. Ages are approximated, based on the growth equation established for Dunk River oysters by Lavoie and Bryan (1981). Figures 4a, b, c, and d present the same data expressed as a percentage of the total number of oysters collected at each station. Approximately 45% (1,137 individuals) of the total number of oysters

collected in the survey (2,508 individuals) were equal to or greater than 2.5 inches (6.5 cm), the cull size for the relay fishery, while about 25% (633 individuals) were equal to or greater than the market size of 3 inches (7.6 cm). From Figure 4c it can be seen that 3 yr old oysters (4.6-6.5 cm) comprised over 25% of the oysters collected in 56.8% (29 of 51 stations) of the total number of stations examined. Oysters 4 yr and older comprised over 25% of the oysters collected in 60.8% of the stations examined. Other ages were less abundant and did not predominate in as large a percentage of the stations occupied. This suggests that fishing efficiency, fishing effort, or both may have been lower in 1973 than in other years since there was a very large percentage of individuals above the cull size of 6.5 cm left on the fishing grounds (Hawkins and Rowell 1985a, b, c, d, e, and f).

Histograms showing the size distribution at each station with more than 10 individuals m^{-2} are presented in Figure 5. Lower densities were not considered representative of populations within a square meter quadrat. As in previous years (Hawkins and Rowell 1985a and b), the size frequency distributions at individual stations in the two principal fishing areas indicated that these areas receive more regular spatfall settlement and probably have better rates of survival than do other areas within the Estuary. This is indicated by the wide size range of oysters collected at each station in the two areas (Stations 6-16, 24-28, and 39-42) together with similar patterns in the overall size frequency distribution pattern among stations within each area. Areas which are outside the main fishing regions exhibit marked irregular patterns in both the overall size frequency distributions among stations and the size range of oysters collected at each station.

A composite size frequency distribution (Fig. 6) constructed from all data provides a means to compare the 1973 population size structure with those observed in previous and subsequent years. The population size structure in 1973 shows a unimodal distribution pattern. This mode appears to be a composite of ages 2 and 3 yr old oysters (2.6-6.5 cm), with 2 yr olds accounting for 24.7% of the total population surveyed and 3 yr olds accounting for 33.5%. Together they comprise 58.2% of the sampled population. Oysters 4 yr old and older were also abundant, accounting for 37.7% of the population. In the previous year (1972) (Hawkins and Rowell 1985b), the population size frequency structure was bimodal, with 1 and 2 yr old oysters together accounting for 62.2% of the total population examined. Three and 4 yr old and older oysters accounted for the remainder of the population and formed the second mode. In comparison to all subsequent years (Hawkins and Rowell 1985c, d, e, and f), the 1973 population structure differs in that there is only one prominent mode.

SUMMARY

1. Oyster density ranged from 0-306 individuals m^{-2} over all stations, 41.2% of the stations having low densities (≤ 10 m^{-2}), 43.1% having intermediate densities (11-100 m^{-2}), and 15.7% having high densities (>100 m^{-2}).

2. Size frequency distributions for individual stations indicate that in the principal fishing areas spatfall settlement and survival is more regular than in other areas of the Estuary.

3. The population structure showed 1 and 2 yr old oysters together comprising only 28.8% of the total population, 1 yr olds accounting for 4.1%, and 2 yr olds 24.7%. Oysters 3 yr old accounted for 33.5%, and oysters 4 yr old and older 37.7%.

4. The high percentage of 2 and 3 yr old oysters reflects the continued good survival of the 1970 and 1971 year classes.

5. Spat settlement and (or) survival of the 1972 year class appears to have been very poor.

ACKNOWLEDGEMENTS

We wish to thank R.E. Lavoie for planning and implementing the survey and C.F. Bryan for his assistance in collection and processing field samples. B. Mullen and D. Whillans assisted in data processing and graphic presentation.

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Table 1. Density per square meter, range of 0.5 cm size classes, mean size (in centimeters), and standard deviation of oysters collected at each station in 1973.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
A	1	1	5.0- 5.5	5.5	
	2	0			
	3	4	2.5-11.0	7.00	4.34
	4	33	1.0-10.5	6.02	2.45
	5	31	3.0-12.0	6.21	2.14
	6	37	1.0-13.5	7.30	3.20
	7	168	2.0-12.0	6.14	2.16
	8	132	1.0- 9.0	5.80	1.68
	9	178	1.0-12.5	5.80	2.31
	10	303	1.5-14.0	6.17	2.73
	11	280	1.5-13.5	6.95	3.01
	12	37	2.0-10.0	5.61	2.13
	13	0			
	14	0			
	15	192	1.5-14.0	6.45	2.83
	16	156	2.5-12.0	5.33	2.08
B	17	15	1.5-11.0	6.23	2.76
	18	5	4.5-11.0	7.30	2.39
	19	20	3.5- 9.0	5.05	1.63
	20	12	3.5-10.0	6.25	1.96
	21	8	4.0-10.0	6.44	2.21
	22	15	1.0- 9.5	4.67	2.53
	23	17	3.0-11.5	7.50	2.70
	24	35	2.5-11.5	6.90	2.28
	25	82	2.5-11.5	5.89	2.09
	26	92	3.0-11.0	6.95	1.87
	27	96	2.0-14.5	6.95	2.46
	28	63	3.0-12.0	6.45	2.36
	29	11	5.0-10.0	7.55	1.68
	30	0			
	31	7	2.0- 8.0	4.00	2.29
	32	208	2.5-10.5	5.84	1.52
C	33	0			
	34	0			
	35	0			
	36	0			
	37	1	17.5-18.0	18.0	
	38	15	1.5-11.0	6.23	2.76
	39	28	3.5-11.5	7.34	2.12

...Cont'd.

Table 1. Cont'd.

Transect line	Station number	Number m^{-2}	Range of 0.5 cm size classes	Mean size (cm)	Standard deviation
	40	40	4.0-10.5	7.40	1.63
	41	37	3.0- 9.5	6.19	1.64
	42	96	2.0-11.0	5.91	1.71
	43	7	4.5-10.0	6.50	1.76
D	44	4	2.5- 9.0	6.00	3.46
	45	14	4.5-12.0	7.36	1.69
	46	16	3.5- 4.0	7.25	1.91
	47	0			
	48	0			
	49	0			
	50	9	6.5-13.0	9.17	2.00
	51	0			

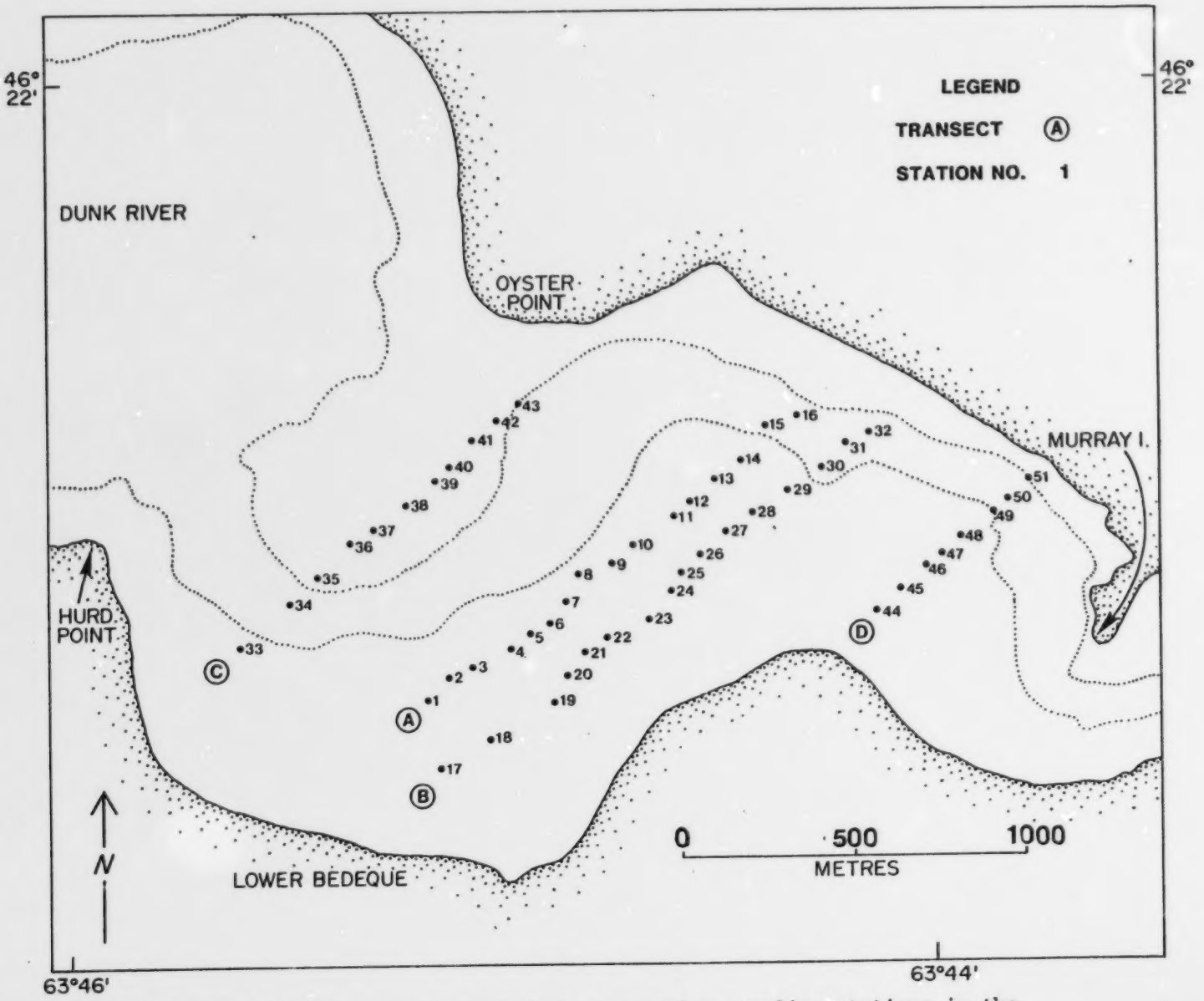


Figure 1. Positions of transects and their respective sampling stations in the Dunk River Estuary, 1973.

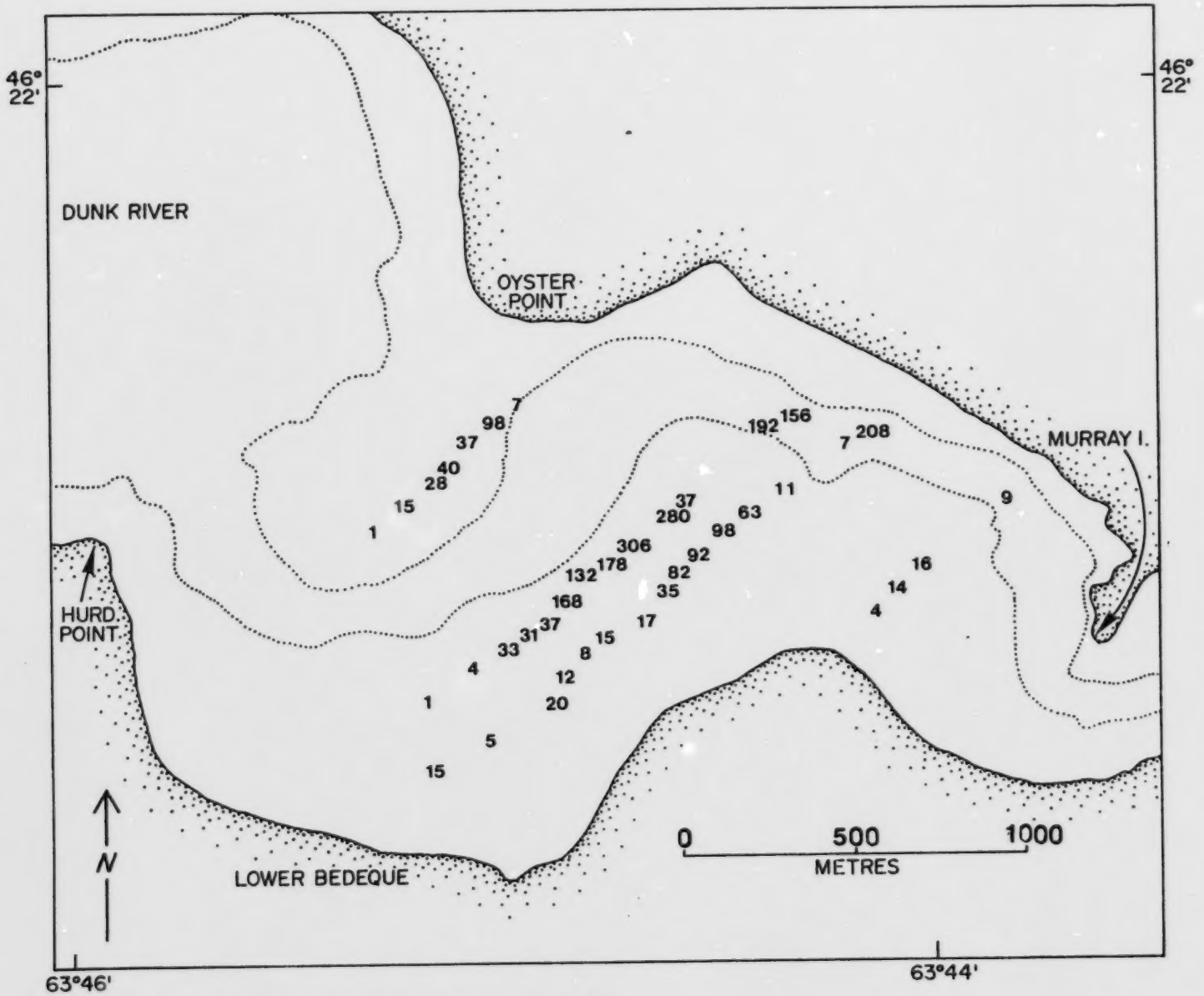


Figure 2. Number of oysters per square metre.

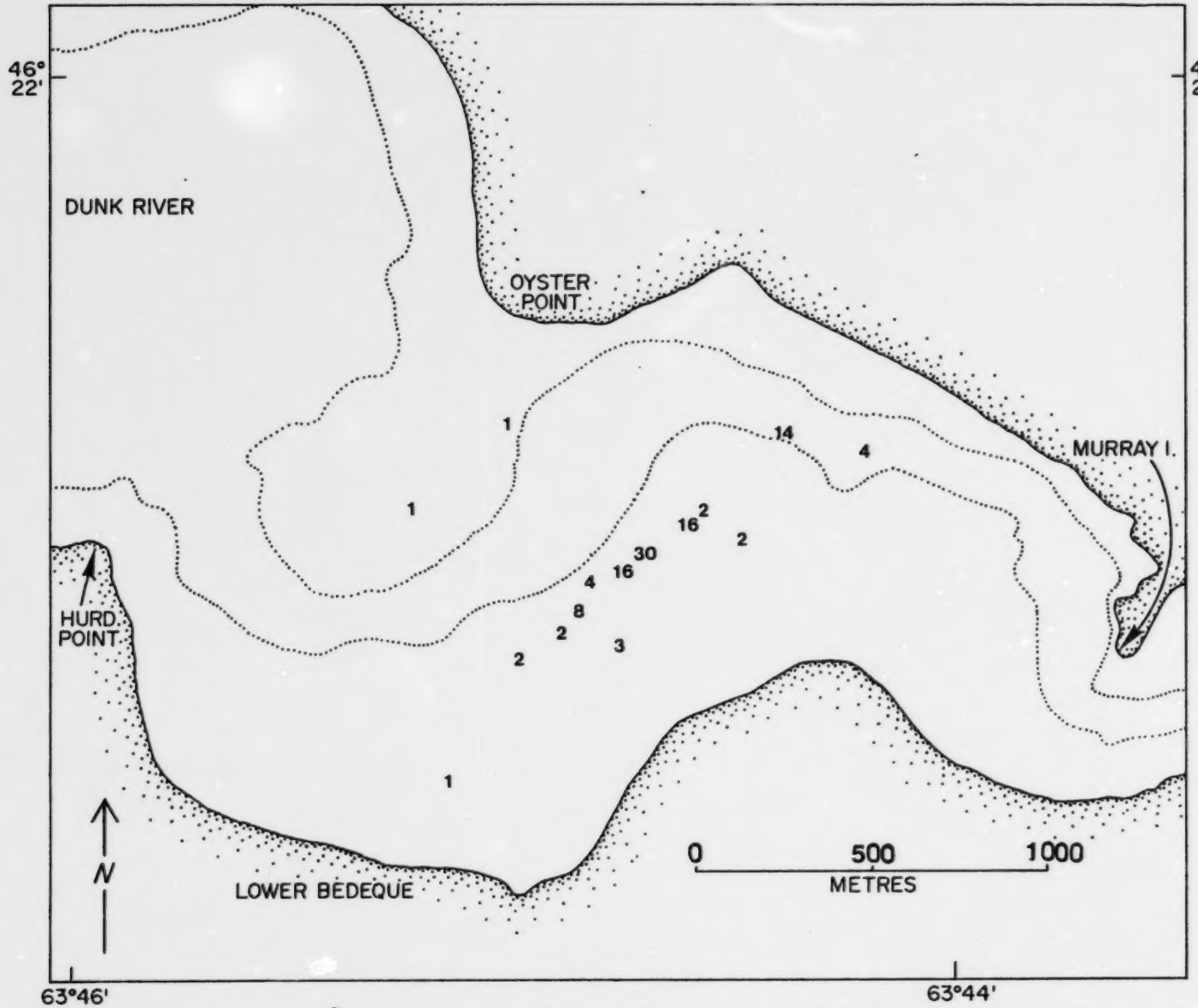


Figure 3a. Density m^{-2} of 1 yr old oysters ($\leq$ 2.5 cm) collected at each station.

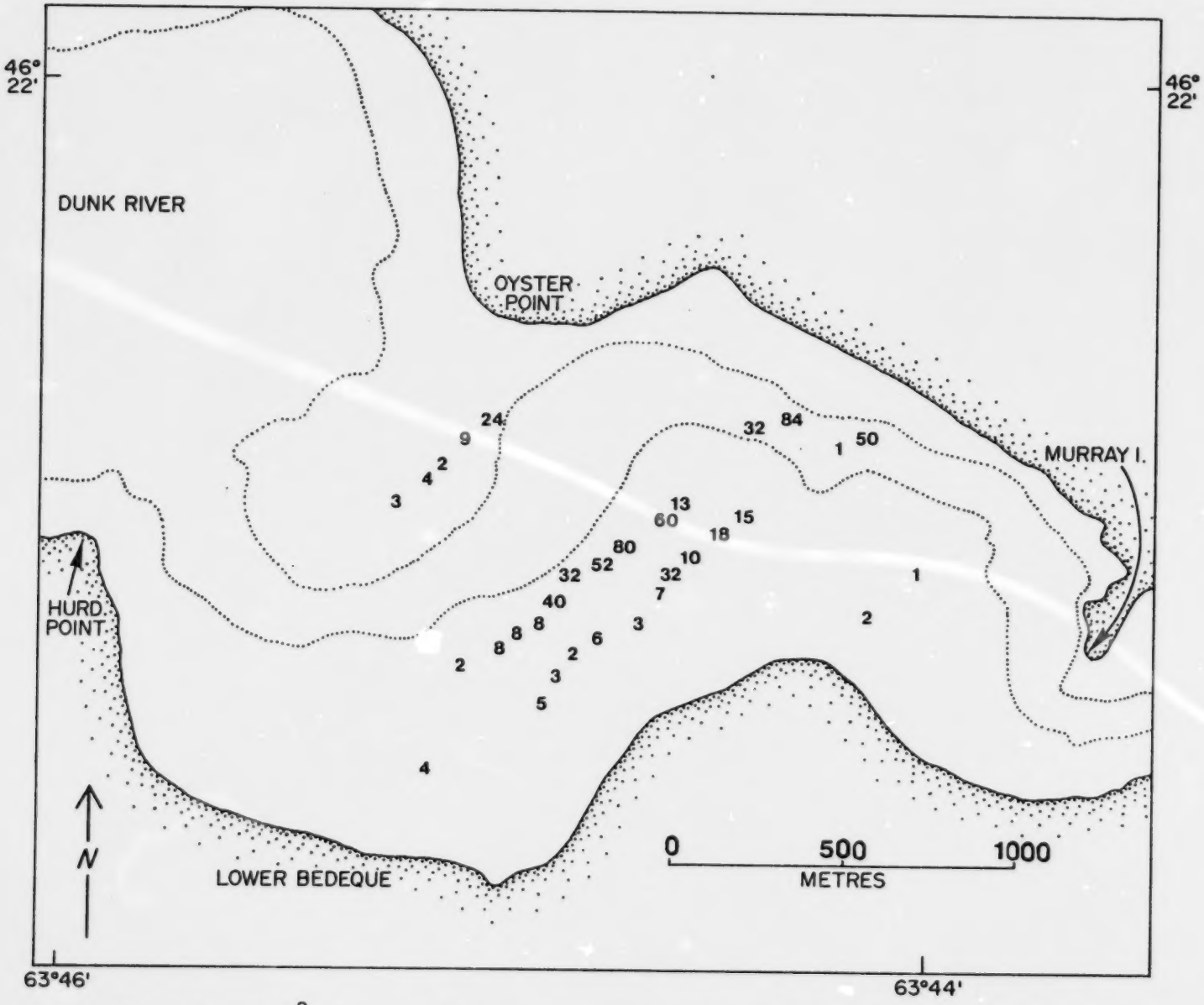


Figure 3b. Density m^{-2} of 2 yr old oysters (2.6 to 4.5 cm) collected at each station.

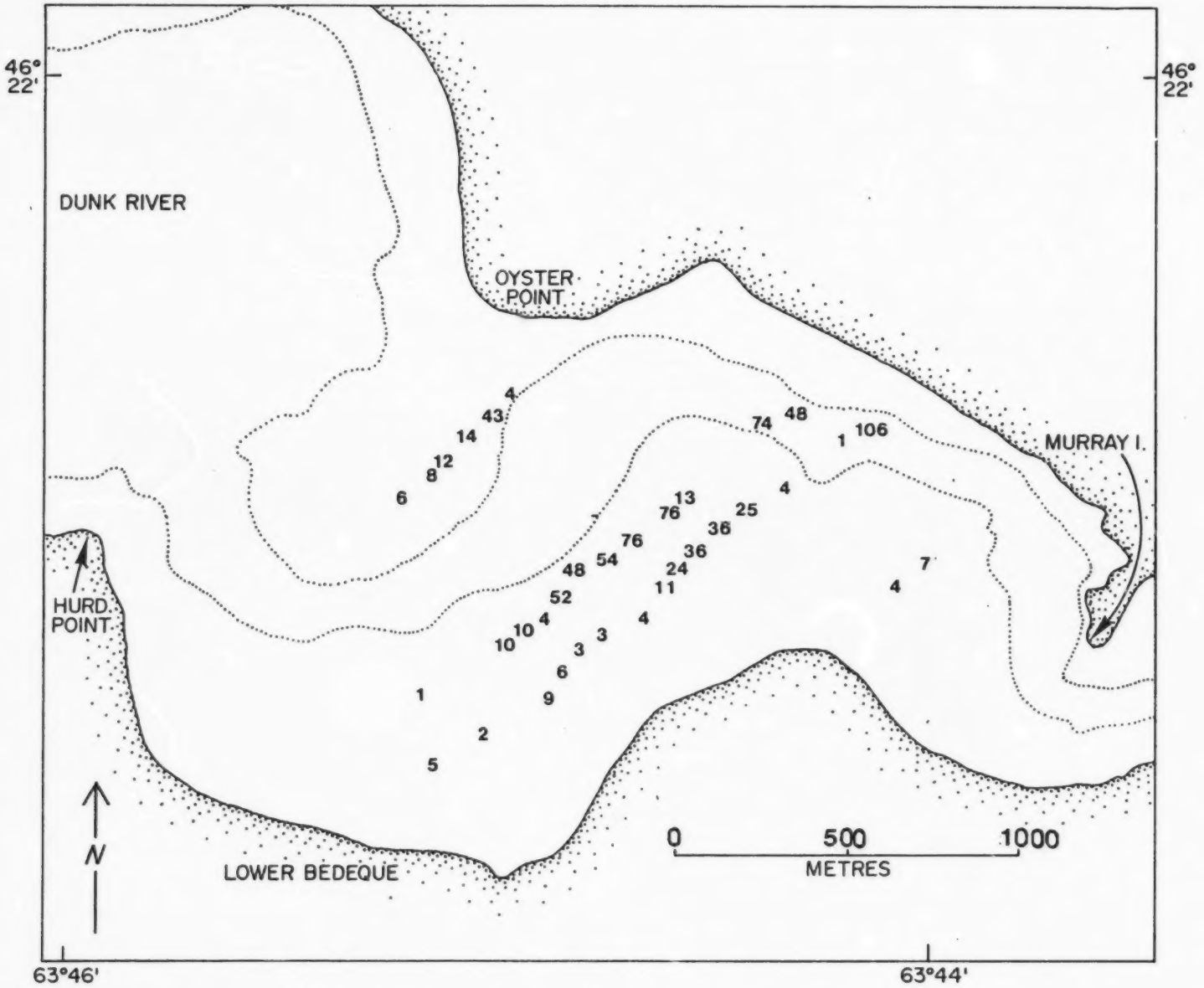


Figure 3c. Density m^{-2} of 3 yr old oysters (4.6 to 6.5) collected at each station.

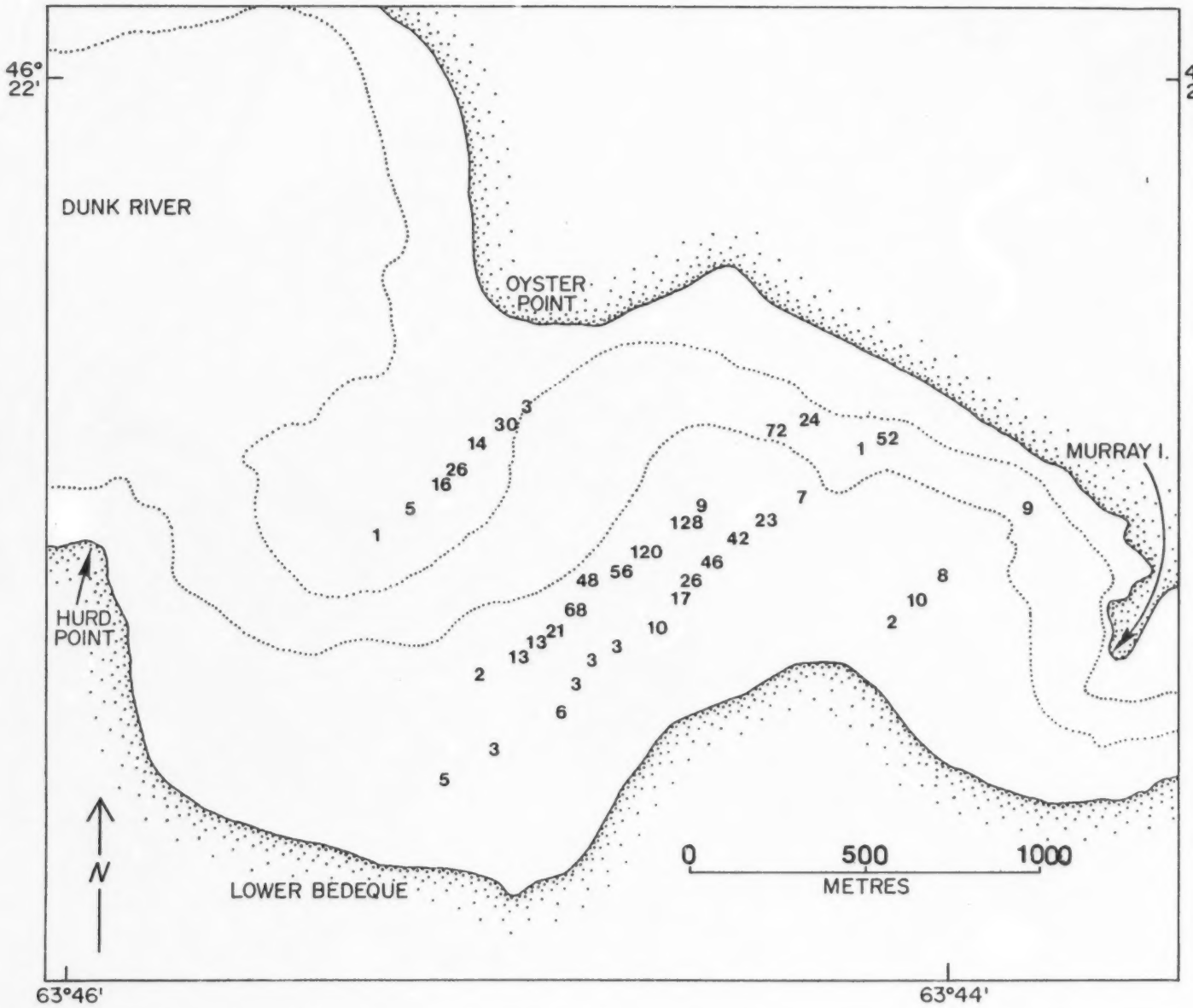


Figure 3d. Density m^{-2} of 4+ yr old oysters (>6.5 cm) collected at each station.

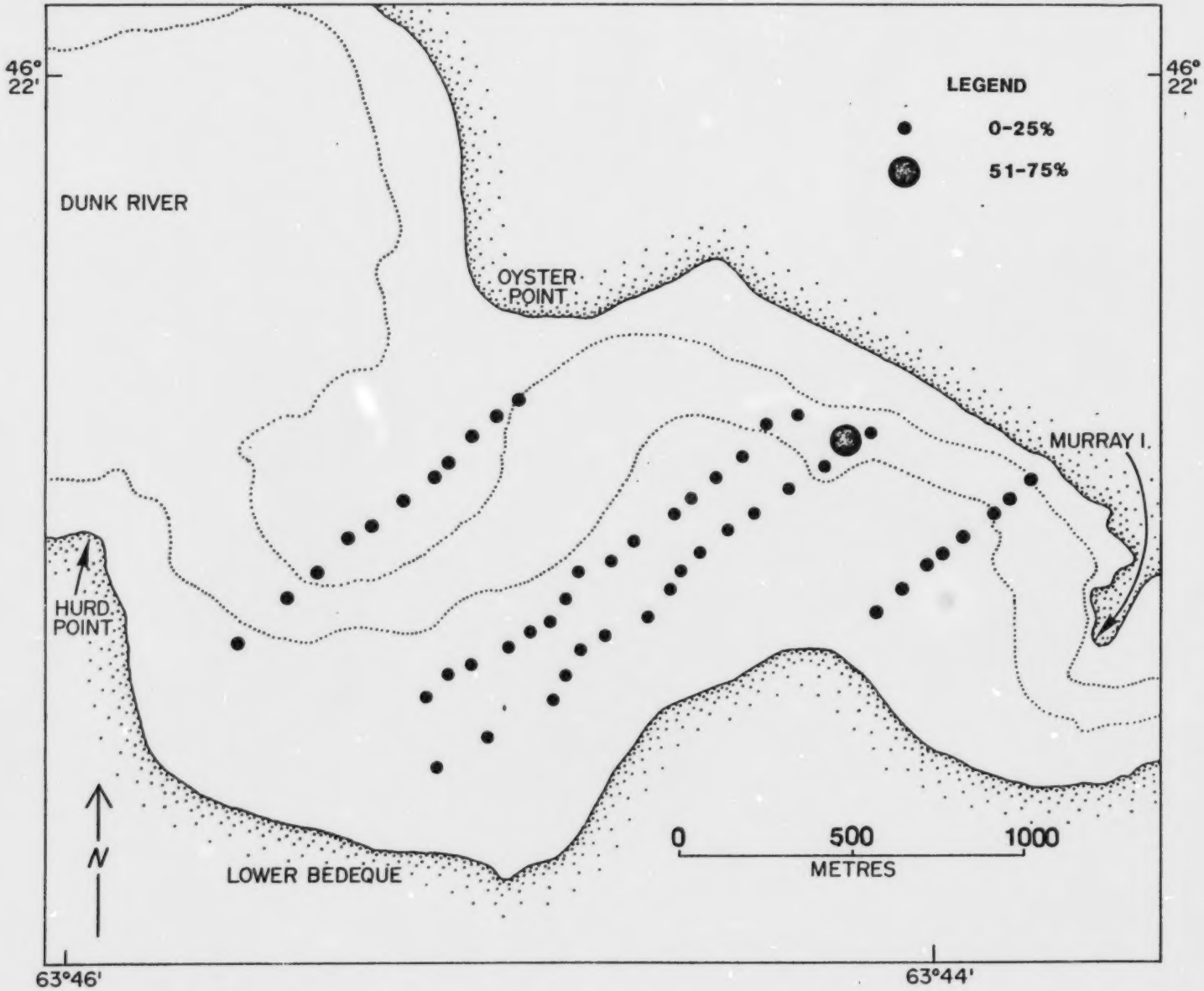


Figure 4a. Percentage of 1 yr old oysters (≤ 2.5 cm) collected at each station.

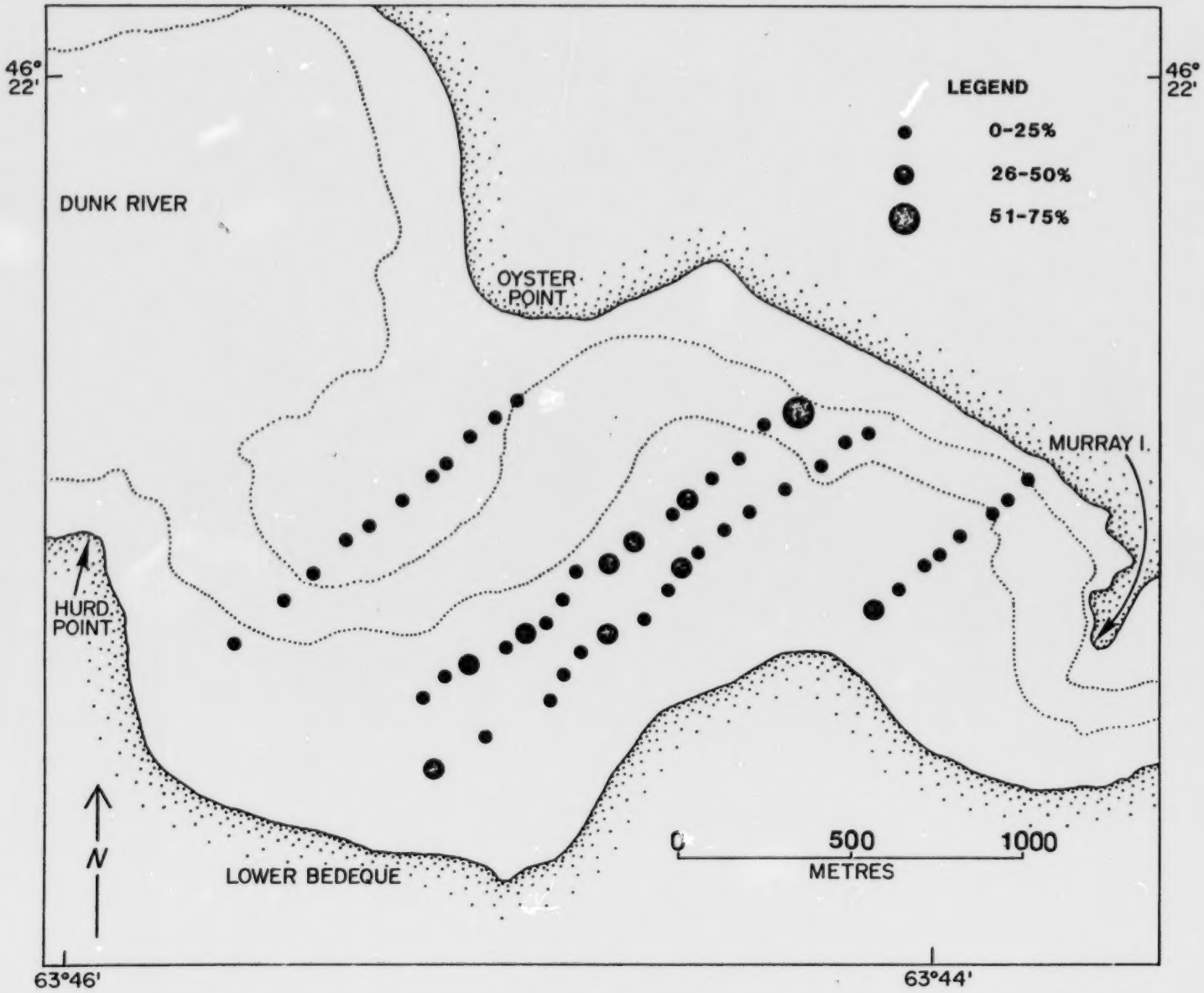


Figure 4b. Percentage of 2 yr old oysters (2.6 to 4.5 cm) collected at each station.

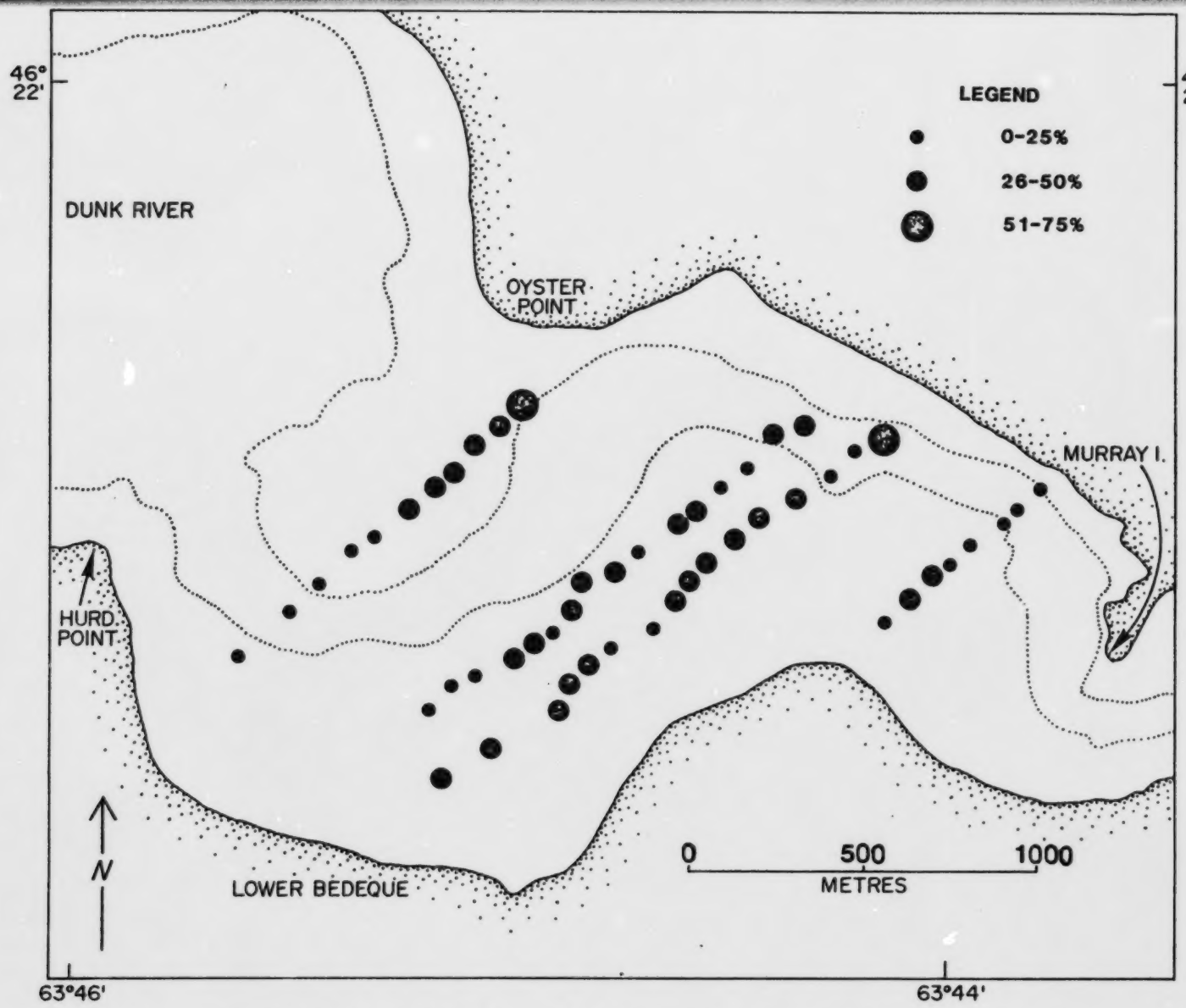


Figure 4c. Percentage of 3 yr old oysters (4.6 to 6.5 cm) collected at each station.

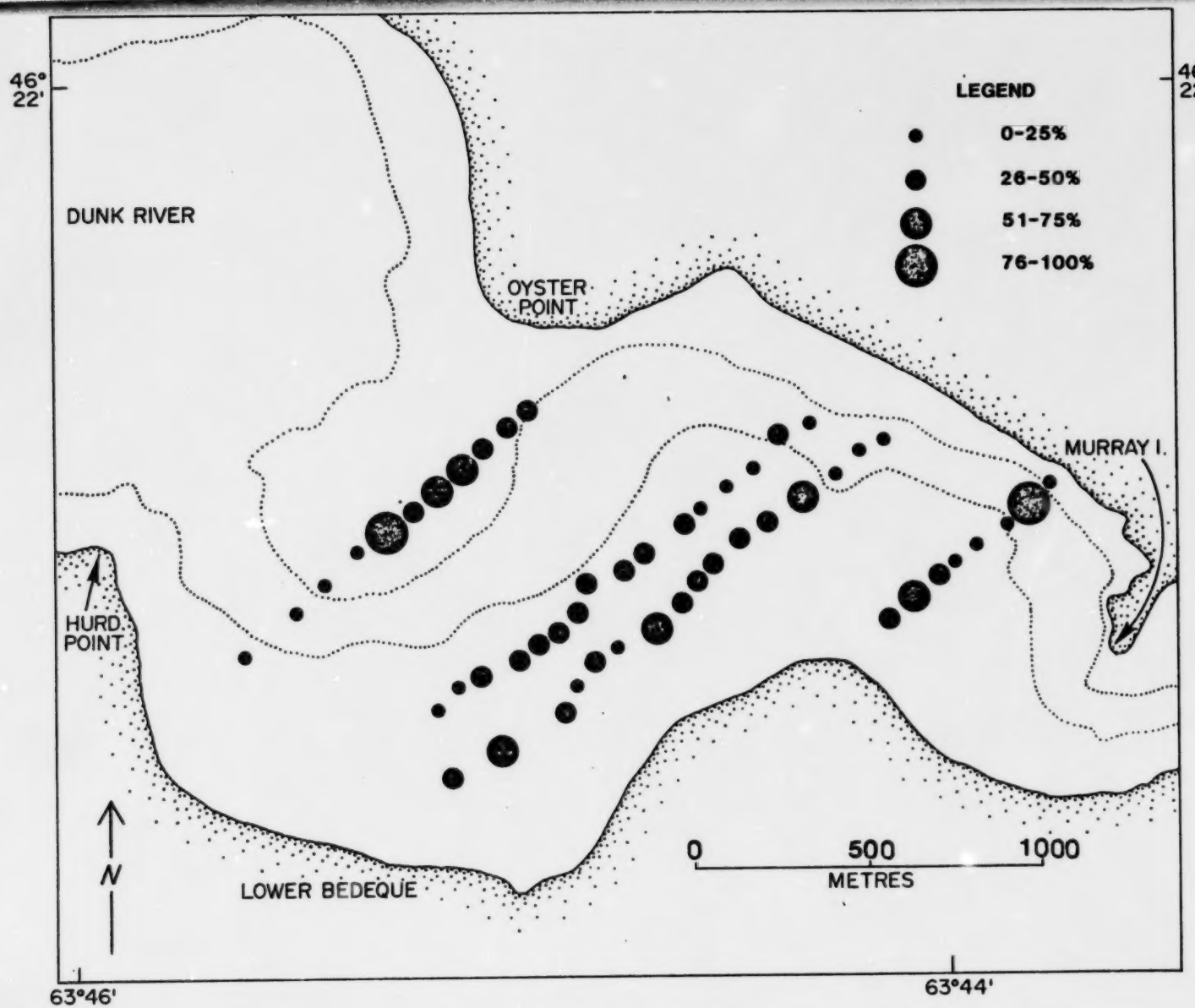


Figure 4d. Percentage of 4+ yr old oysters (>6.5 cm) collected at each station.

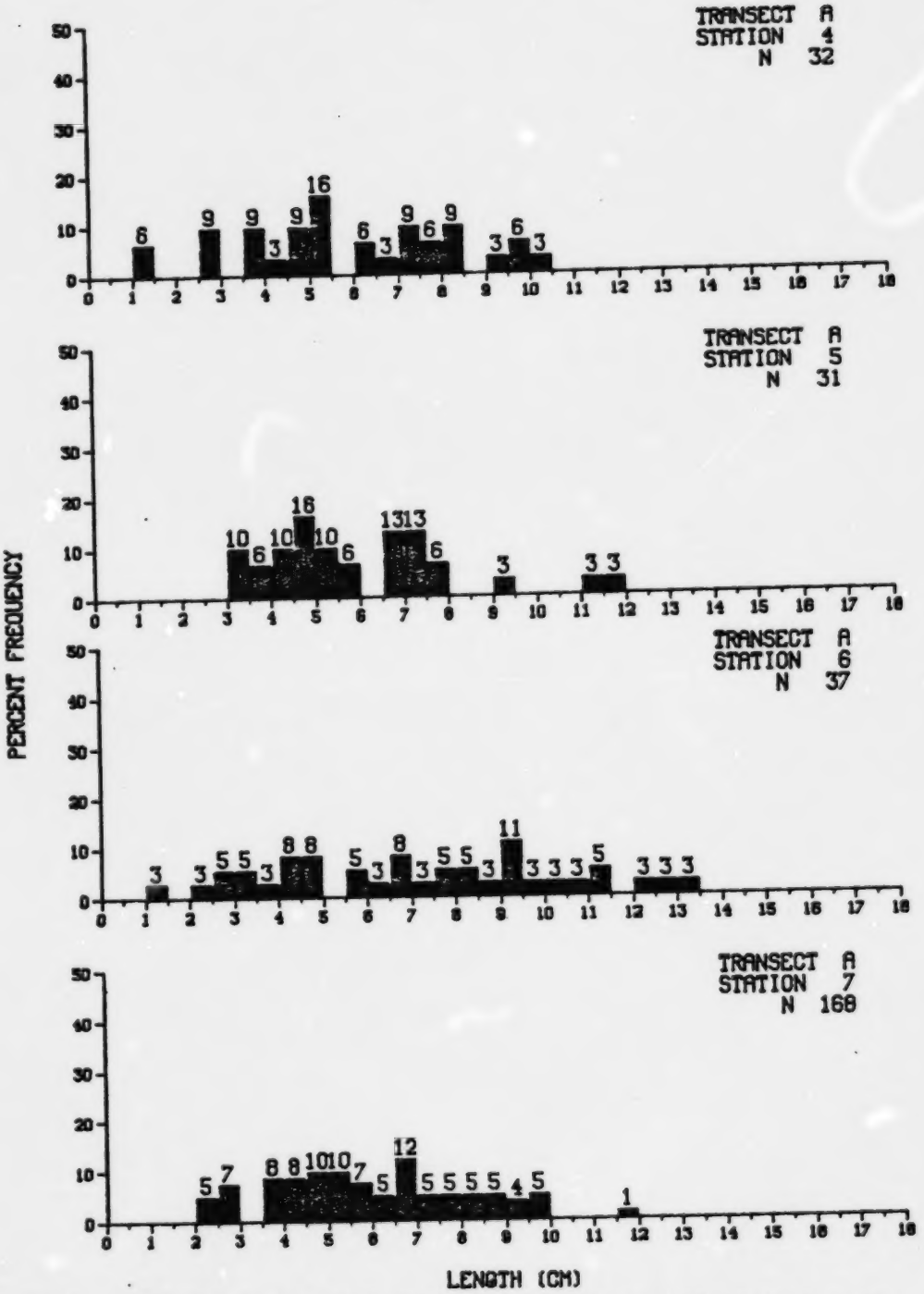
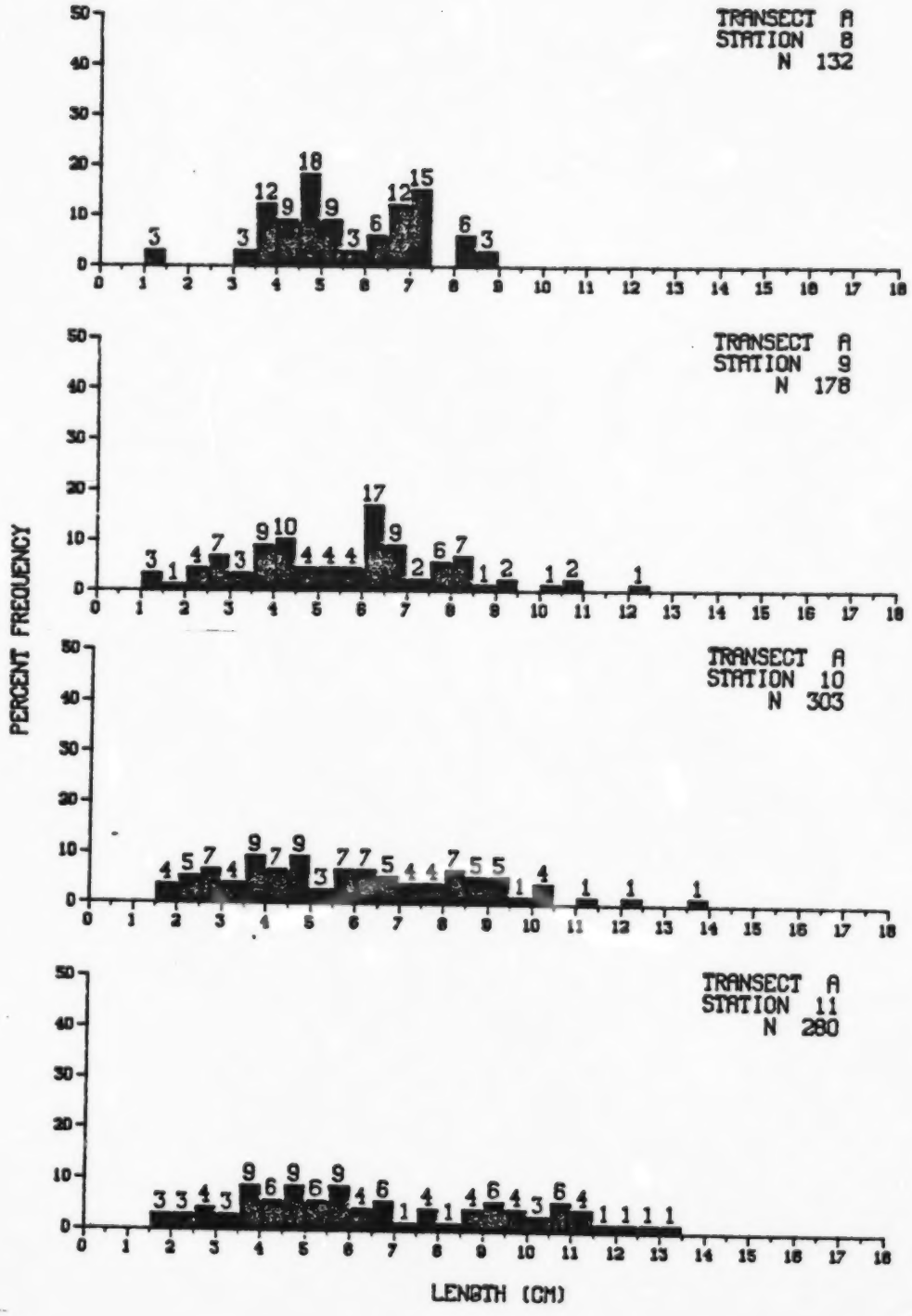


Figure 5. Size frequency distribution of oysters collected at each station in 1973: 1 yr olds < 2.5 cm in length, 2 yr olds 2.6-4.5 cm, 3 yr olds 4.6-6.5 cm 4,+ yr olds >6.5 cm.



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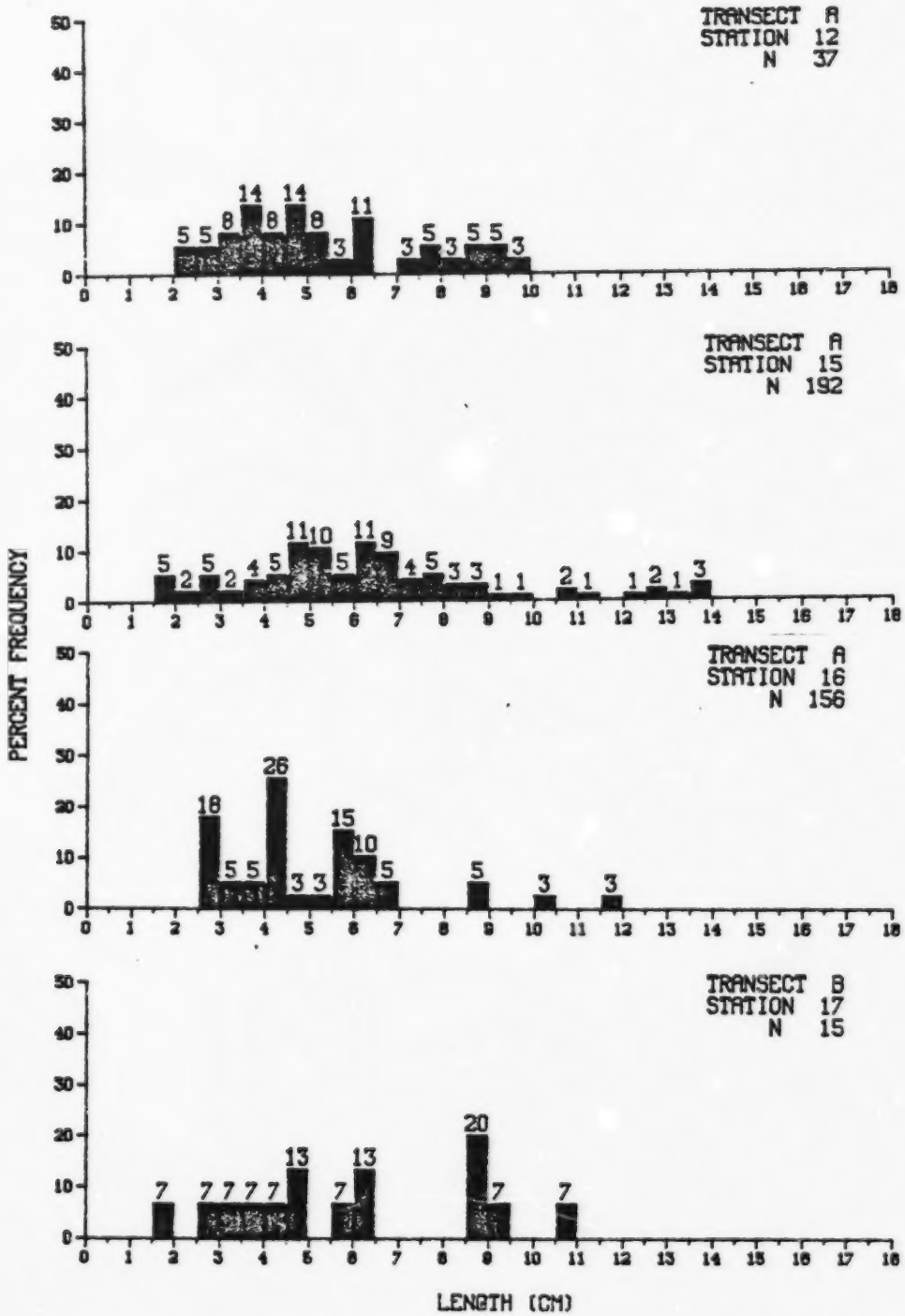

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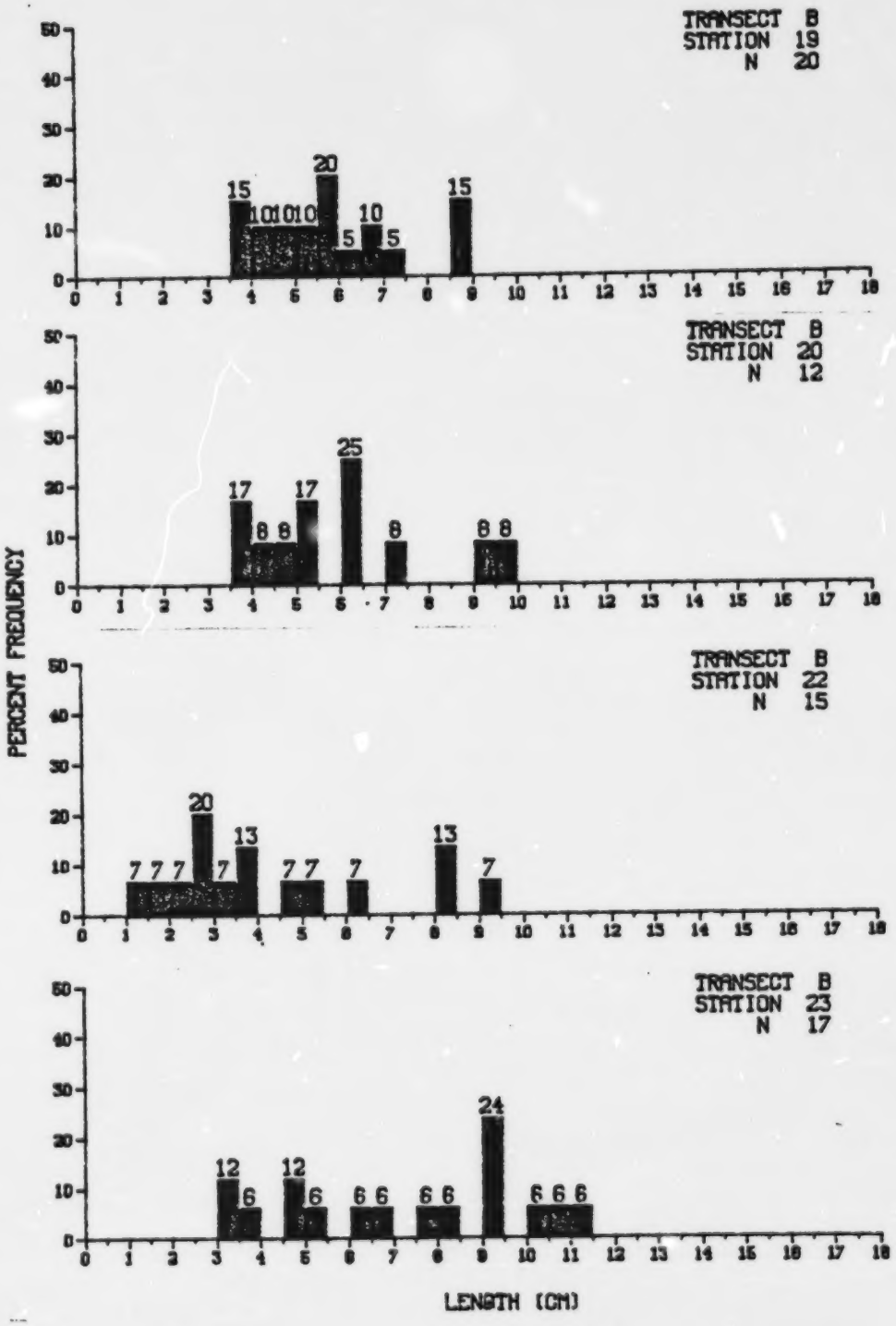

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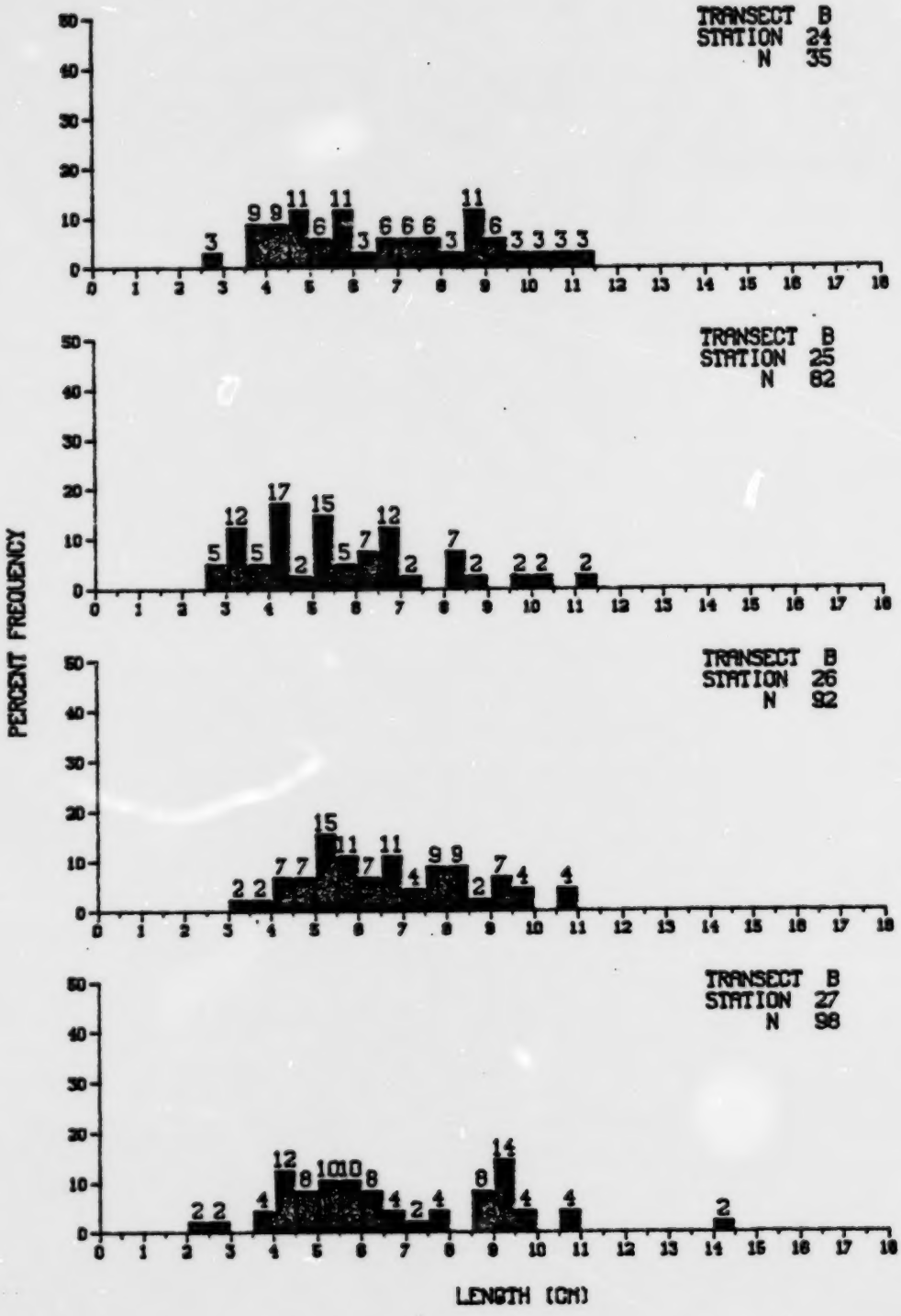

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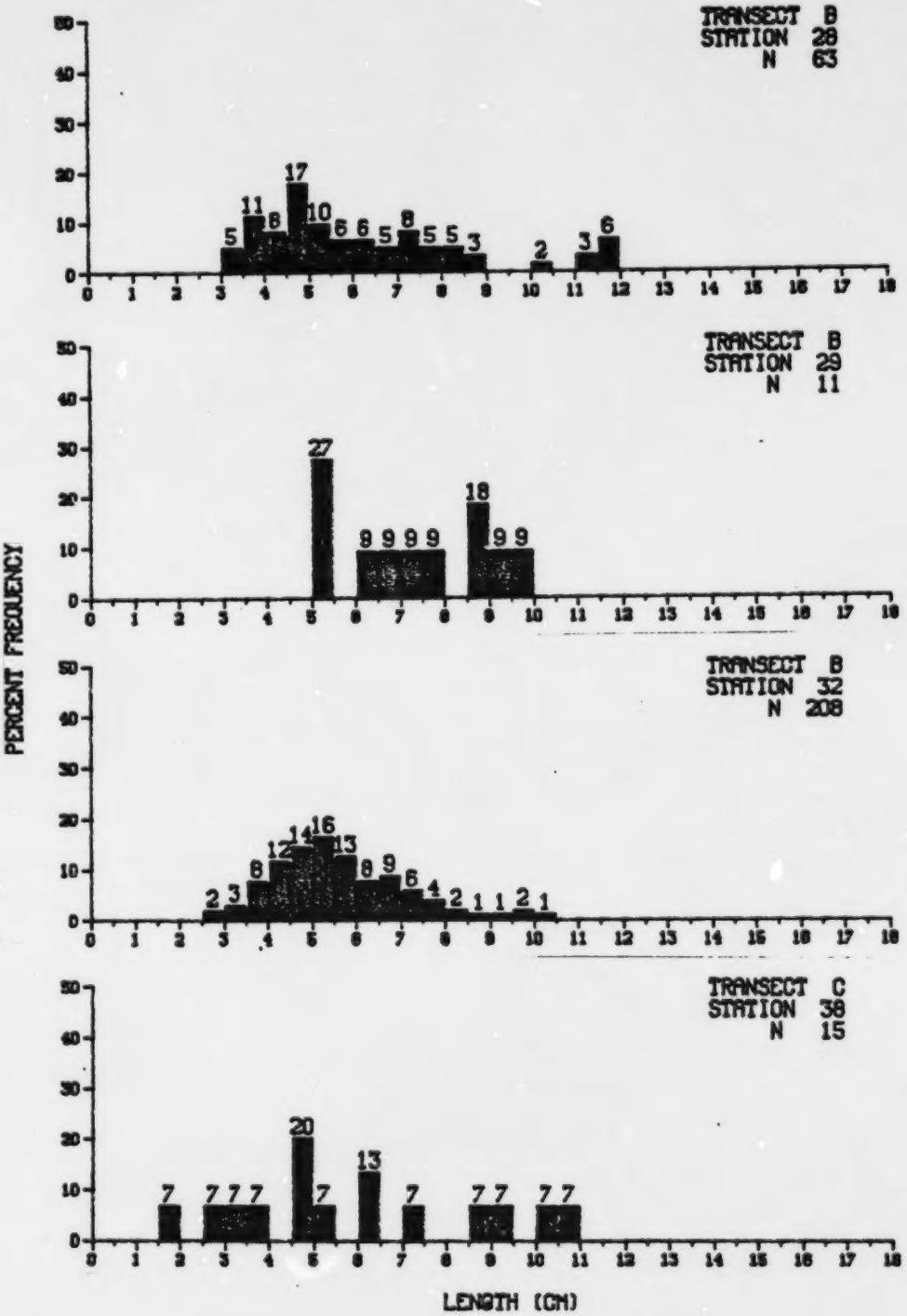

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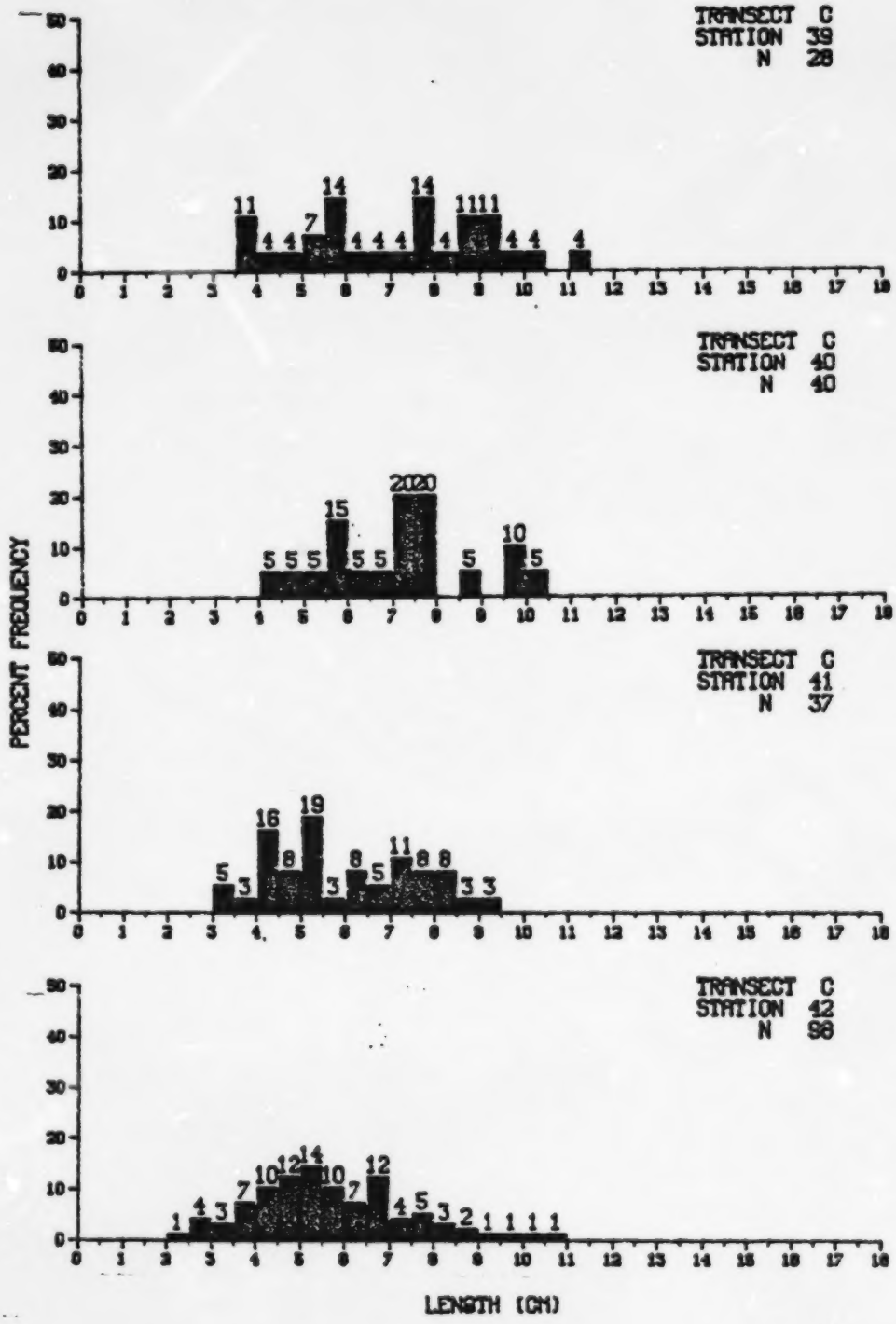

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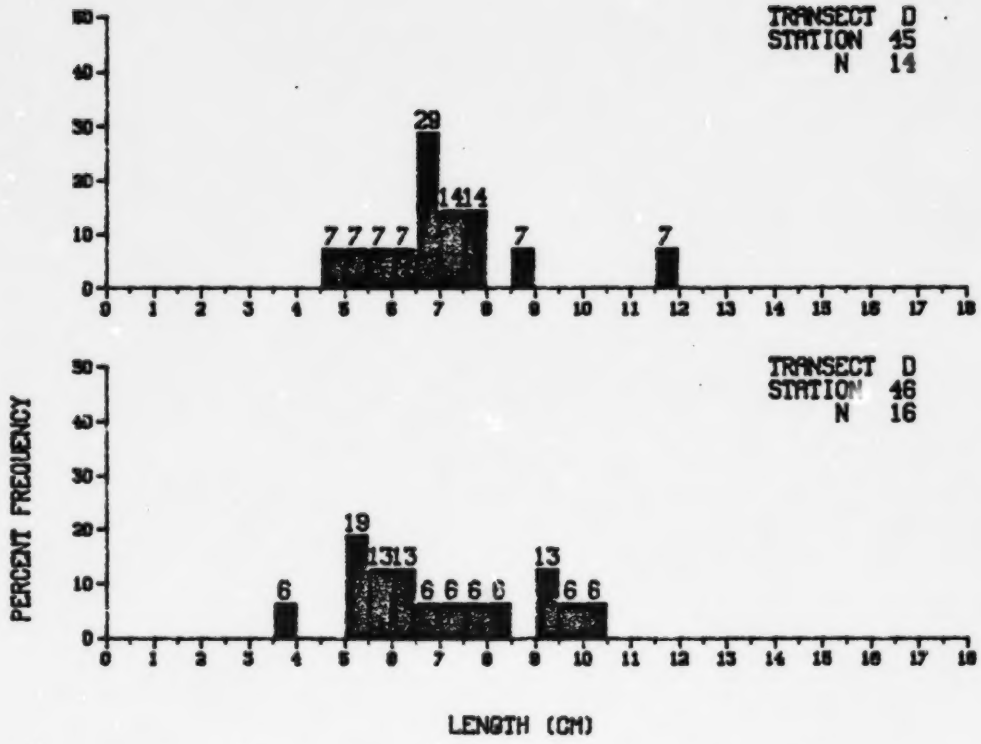

Figure 5. Cont'd.

TOTAL N = 2508.0

SIZE (CM)	FREQ. %	SIZE (CM)	FREQ. %
0.5	0.00	8.5	3.78
1.0	0.00	10.0	2.19
1.5	0.56	10.5	1.67
2.0	1.36	11.0	1.59
2.5	2.19	11.5	1.16
3.0	4.94	12.0	0.64
3.5	3.31	12.5	0.52
4.0	7.30	13.0	0.40
4.5	8.13	13.5	0.28
5.0	8.49	14.0	0.40
5.5	8.61	14.5	0.08
6.0	7.78	15.0	0.00
6.5	7.66	15.5	0.00
7.0	7.81	16.0	0.04
7.5	4.63	16.5	0.00
8.0	4.55	17.0	0.00
8.5	3.95	17.5	0.00
9.0	3.99	18.0	0.00

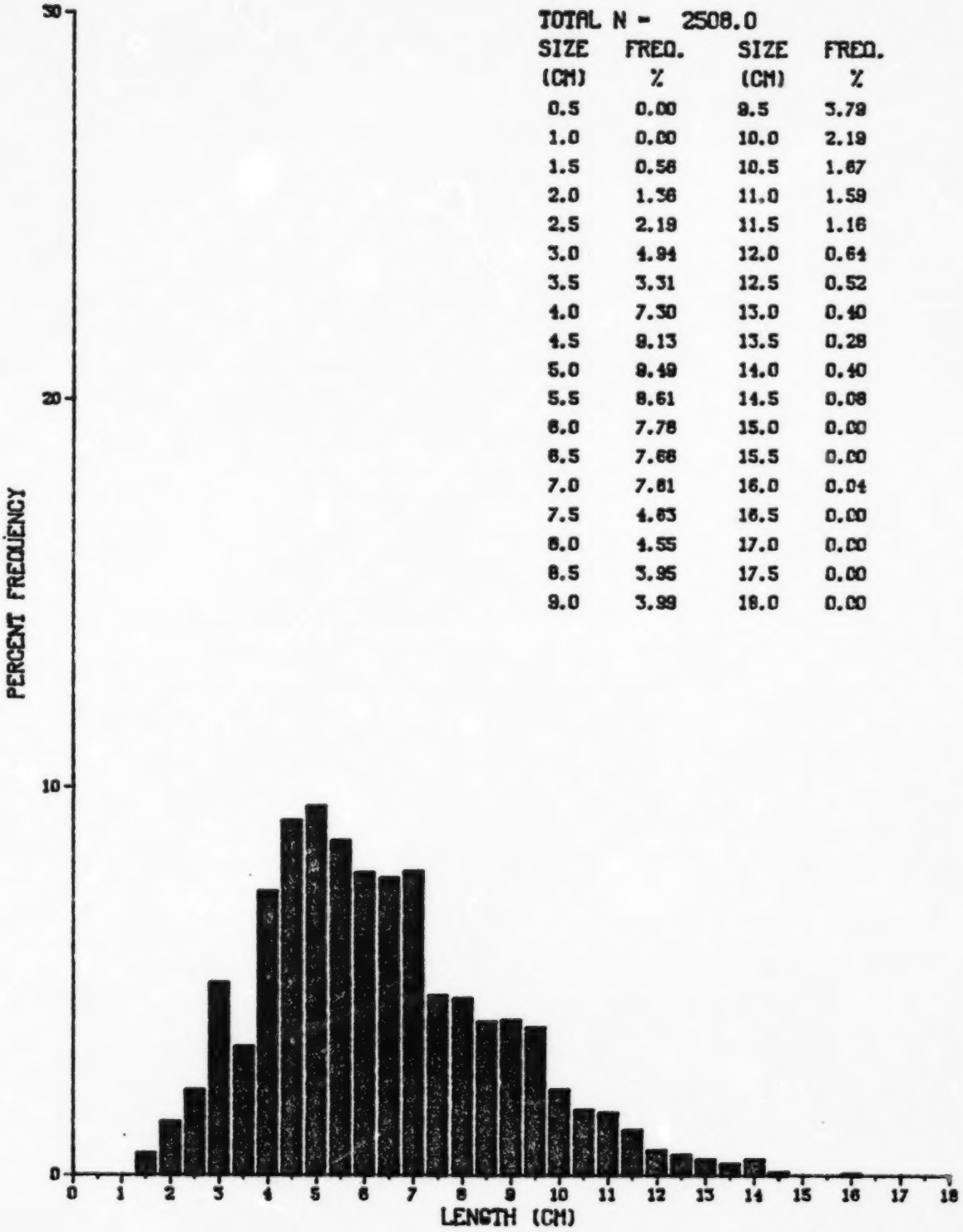

Figure 6. Size frequency distribution of oysters collected over all stations in 1973: 1 yr olds < 2.5 cm in length, 2 yr olds 2.6-4.5 cm, 3 yr olds 4.6-6.5 cm and 4,+ yr olds >6.5 cm.